

What Is Claimed Is:

1. A multi-point data acquisition apparatus comprising a main module which performs serial communication through a serial bus to multiple measurement modules connected to a single-system serial bus, wherein said main module comprises:

a timing generating unit which outputs a first timing signal and second timing signal;

a setting unit which sets multiple transmission destinations which are measurement modules to be engaged in serial communication, and multiple transmission contents, based on said first timing signal from said timing generating unit; and

a communication processing unit which holds said multiple transmission destinations and multiple transmission contents set by said setting unit, and, based on said second timing signal from said timing generating unit, sequentially sends transmission contents through said serial bus to said multiple measurement modules set as transmission destinations, performing serial communication.

2. The multi-point data acquisition apparatus of claim 1, wherein said communication processing unit comprises:

a storage means which stores multiple transmission destinations and respective transmission contents which are set by said setting unit; and

a sending/receiving means which reads said transmission destinations and transmission contents of said storage means and sequentially sends said transmission contents through said serial bus to said multiple measurement modules set as transmission destinations, performing serial communication, based on said second timing signal from said timing generating unit.

3. The multi-point data acquisition apparatus of claim 2, wherein when serial communication with a measurement module which is a transmission destination set in said storage means ends, said communication processing unit erases said

transmission destination which has completed serial communication from said storage means.

4. The multi-point data acquisition apparatus of claim 2 or 3, wherein said setting unit sets transmission destinations and transmission contents in said storage means to be offset from the times at which said sending/receiving means of said communication processing unit reads said transmission destinations and transmission contents from said storage means.

5. The multi-point data acquisition apparatus of any of claims 1 through 4, wherein said timing generating unit comprises:

a real-time clock which outputs a clock signal at prescribed time intervals;

and

a signal generating means which outputs a first timing signal and second timing signal based on said clock signal from said real-time clock;

and said first and second timing signals are output at time intervals which differ from the time interval of said clock signal.

6. The multi-point data acquisition apparatus of claim 5, wherein said signal generating means has different time intervals for outputting said first timing signal and said second timing signal.

7. A multi-point data acquisition apparatus comprising a main module which performs serial communication through a serial bus to multiple measurement modules connected to a single-system serial bus, wherein said main module comprises:

a setting unit which sets a prescribed module, among said multiple measurement modules, as a polling destination;

a communication processing unit which collects data by polling from said measurement module set as said polling destination by said setting unit; holds a communication history based on a communication content at the time of data collection; and provides notification of said communication content to said setting unit; and

a received-data storage unit which stores data received by said communication processing unit;

and said communication processing unit performs data collection by polling from said measurement modules which do not hold said communication history.

8. The multi-point data acquisition apparatus of claim 7, wherein said communication processing unit comprises:

a polling destination storage means which stores polling destinations;
a communication history storage unit which stores communication histories;
a selection means which reads polling destinations from said polling destination storage means, reads said communication histories from said communication history storage unit, and selects a measurement module lacking said communication histories from said polling destinations; and

a sending/receiving means which collects data by polling with a measurement module selected by said selection means set as a polling destination, and stores, in said communication history storage unit, a communication history based on a communication content at the time of data collection.

9. The multi-point data acquisition apparatus of claim 8, wherein said sending/receiving means treats, as communication histories, cases where communication ends by normal means for the content of communication with a measurement module which is said polling destination and data have been added to a response from said measurement module which is said polling destination, and cases where communication does not end in a normal procedure for said communication content.

10. The multi-point data acquisition apparatus of claim 9, wherein said communication history storage unit comprises:

an error history storage means which stores measurement modules for which communication does not end normally; and

a reception history storage means which stores measurement modules for which communication ends normally and data are received.

11. The multi-point data acquisition apparatus of claim 10, wherein said selection means reads communication histories from at least said error history storage means or said reception history storage means.

12. The multi-point data acquisition apparatus of claim 10 or 11, wherein said received-data storage unit stores data received from said measurement modules separately for each of said measurement modules and said communication processing unit notifies said setting unit when there is a change to said error history storage means or said reception history storage means.

13. The multi-point data acquisition apparatus of claim 12, wherein said received-data storage unit is a ring buffer.

14. The multi-point data acquisition apparatus of claim 12, wherein said received-data storage unit is provided for each of said measurement modules.

15. A multi-point data acquisition apparatus comprising a main module which performs serial communication through a serial bus to multiple measurement modules connected to a single-system serial bus, wherein said main module comprises:

a timing generating unit which outputs timing signals in prescribed periods;
a setting unit which sets transmission contents for a prescribed measurement module among said multiple measurement modules; and

a communication processing unit which receives data by sequentially polling said multiple measurement modules, and sends said transmission contents to said prescribed measurement module set by said setting unit based on a timing signal output from said timing generating unit;

and, when said timing signal is input, said communication processing unit cancels the polling of the next measurement module and sends said transmission contents.

16. The multi-point data acquisition apparatus of claim 15, wherein said setting unit sets said first transmission content and second transmission content with said prescribed measurement module set as a transmission destination, and said communication processing unit sequentially changes to a polling mode for polling, a first transmission mode for sending said first transmission content set by said setting unit with said prescribed measurement module set as said transmission destination, and a second transmission mode for sending said second transmission content set by said setting unit with said prescribed measurement module set as said transmission destination; when said timing signal is input during said second transmission mode, a change to said first transmission mode is made after said second transmission mode ends.

17. The multi-point data acquisition apparatus of claim 17, wherein said communication processing unit comprises:

a first storage means which stores said first transmission content and said transmission destination set by said setting unit;

a second storage means which stores said second transmission content and said transmission destination set by said setting unit;

a mode specifying means which reads said transmission destinations, said first transmission content and said second transmission content from said first storage means and said second storage means respectively, sequentially changes to said polling mode, said first transmission mode, and said second transmission mode, and changes to said first transmission mode based on said timing signal; and

a sending/receiving means which is connected to said serial bus, polls said measurement modules based on instructions from said mode specifying means, and transmits, to said measurement module which is said transmission destination, said first transmission content and said second transmission content, which are output from said mode specifying means.

18. The multi-point data acquisition apparatus of claim 17, wherein when said timing signal is input and said transmission content is stored in said first

storage means, said mode specifying means outputs said first transmission content to said sending/receiving means; and when said second transmission content is stored in said second storage means, outputs said second transmission content to said sending/receiving means.

19. The multi-point data acquisition apparatus of claim 17 or 18, wherein said setting unit sets two or more measurement modules among said multiple measurement modules as transmission destinations, and sets said first transmission content for each of said transmission destinations; said first storage means stores said two or more transmission destinations set by said setting unit, as well as said first transmission content for each of said transmission destinations; and said mode specifying means sequentially outputs, to said sending/receiving means, said first transmission contents for all of said transmission destinations stored in said first storage means based on said timing signal.

20. The multi-point data acquisition apparatus of any of claims 16 through 19, wherein a transmission destination to which said setting unit sends said first transmission content is different from a transmission destination to which it sends said second transmission content.

21. A multi-point data acquisition apparatus comprising a main module which is connected to a single-system serial bus, transmits measurement-start commands through said serial bus in prescribed measurement periods, and receives measurement data, said multi-point data acquisition apparatus further comprising multiple measurement modules which perform measurements after receiving a measurement-start command from said main module through said serial bus; hold said measurement data from said measurements; and transmit said measurement data to said main module after receiving the next measurement-start command.

22. The multi-point data acquisition apparatus of claim 21, wherein said measurement modules comprise:

a communication processing unit which receives a measurement-start command from said main module through said serial bus, and sends measurement data to said main module in response to a measurement-end signal;

a measurement unit which performs measurements on a measurement subject in response to a measurement-start command from said communication processing unit, and outputs a measurement-end signal as well as said measurement data from said measurements;

a delay unit which outputs said measurement-end signal from said measurement unit to said communication processing unit after delaying said measurement-end signal for a prescribed length of time; and

a measurement data holding unit which holds said measurement data from said measurement unit, and outputs said measurement data to said communication processing unit based on said measurement-end signal which is delayed by said delay unit.

23. The multi-point data acquisition apparatus of claim 22, wherein said communication processing unit reads the measurement data of said measurement data holding unit when said measurement-end signal is input from said delay unit.

24. The multi-point data acquisition apparatus of claim 22, wherein said measurement data holding unit outputs said measurement data being held to said communication processing unit when said measurement-end signal output by said delay unit is input.

25. The multi-point data acquisition apparatus of claim 21, wherein said measurement modules comprise:

a communication processing unit which receives a measurement-start command from said main module through said serial bus, and sends measurement data to said main module;

a measurement unit which performs measurements on a measurement subject in response to a measurement-start command from said communication processing unit.

and outputs a measurement-end signal as well as said measurement data from said measurements;

a delay unit which delays said measurement-end signal from said measurement unit for a prescribed length of time; and

a measurement data holding unit which holds said measurement data from said measurement unit, and outputs said measurement data being held to said communication processing unit when said measurement-end signal, which is output from and delayed by said delay unit, is input.